What is claimed is:

1. An apparatus for manufacturing a carbon nanotube, comprising:

at least two electrodes whose tips oppose to each other;

a power supply which applies a voltage between the electrodes so as to generate discharge plasma in a discharge area between the electrodes;

a plurality of magnets which generates at least one of a magnetic field of multiple directions and a magnetic field having a component in parallel with the direction of a discharge current in the generation area of the discharge plasma; and

a magnet cooling unit which cools the magnets.

2. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein the magnet cooling unit is formed by attaching a heat releasing member to the magnets.

3. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein the magnet cooling unit is formed by bringing a cooling tube in contact with the magnets, and circulates a coolant in the cooling tube.

4. An apparatus for manufacturing a carbon nanotube according to claim 1, further comprising an electrode cooling unit which cools at least one of the two electrodes.

5. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein the discharge plasma generated in the discharge

area is arc plasma.

6. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein:

the plural magnets are selected from the group consisting of permanent magnets and electromagnets arranged along the direction of the discharge current so as to surround at least of the generation area of the discharge plasma and an area close the generation area; and

each of the plurality of magnets is arranged to direct the same pole toward the discharging area.

7. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein:

the plurality of magnets includes even number of magnets, equal to or greater than four, selected from the group consisting of permanent magnets and electromagnets arranged along the direction of the discharge current so as to surround at least one of the generation area of the discharge plasma and an area close to the generation area; and

each of the plurality of magnets is arranged to have a pole opposite to that of the adjacent magnet directed toward the discharging area.

8. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein the magnets is formed of one of one and two coils whose center axis is approximately aligned to the direction

of the discharge current.

9. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein, of the two electrodes, the magnetic flux density at an edge of the tip of the electrode which generates the discharge plasma is equal to or more than 10^{-5} T and equal to or less than 1 T.

10. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein a density of the discharge current when the discharge plasma is generated is 0.05 A/mm^2 or more and 15 A/mm^2 or less with respect to an area of the tip of the electrode which generates the discharge plasma.

11. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein the voltage applied to the electrodes by the power supply is equal to or more than 1 V and equal to or less than 30 V.

12. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein the voltage applied to the electrodes by the power supply is a DC voltage.

13. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein:

the voltage applied to the electrodes by the power supply is a DC voltage; and

the area of the tip of a cathode of the two opposing electrodes is equal to or less than the area of the tip of an anode thereof.

14. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein at least the discharge area and the electrodes are received in a sealed container.

15. An apparatus for manufacturing a carbon nanotube according to claim 1, further comprising an atmosphere adjusting unit which adjusts at least one of a pressure and a gas type of an atmosphere in a sealed container, wherein at least the discharge area and the electrodes are received in the sealed container.

16. An apparatus for manufacturing a carbon nanotube according to claim 1, wherein the material of the electrodes is one of carbon and a substance which contains carbon and has an electric resistivity equal to or more than 0.01 Ω·cm and equal to or less than 10 Ω·cm.

17. A method of manufacturing a carbon nanotube by applying a voltage between two electrodes whose tips oppose to each other, and then, generating discharge plasma in a discharge area between the electrodes, the method comprising:

using a plurality of magnets to generate at least one of a magnetic field of multiple directions and a magnetic field having a component in parallel with the direction of a discharge current in the generation area of the discharge plasma; and

cooling the plurality of magnets.

18. A method of manufacturing a carbon nanotube according to claim 17, further comprising controlling a temperature of the plural magnets under a Curie temperature.

19. A method of manufacturing a carbon nanotube according to claim 17, further comprising controlling a period of time when the voltage is applied between the two electrodes appropriately.

20. A method of manufacturing a carbon nanotube according to claim 17, further comprising cooling the two electrodes.

21. A method of manufacturing a carbon nanotube according to claim 17, wherein the discharge plasma generated in the discharge area is arc plasma.

22. A method of manufacturing a carbon nanotube according to claim 17, further comprising forming the magnetic field by arranging the plural magnets selected from the group consisting of permanent magnets and electromagnets along the direction of the discharge current so as to surround at least one of the generation area of the discharge plasma and an area close to the generation area and such that each of the plural magnets is arranged to direct the same pole toward the discharging area.

23. A method of manufacturing a carbon nanotube according to claim 17, further comprising forming the magnetic field by arranging even number of magnets, equal to or greater than four, selected from the group consisting of permanent magnets and electromagnets along the direction of the discharge current so as to surround at least one of the generation area of the discharge plasma and an area close to the generation area and such that each of the plural magnets has a pole opposite to that of the adjacent magnet directed

toward the discharging area

24. A method of manufacturing a carbon nanotube according to claim 17, wherein the magnetic field is formed by disposing one of one and two coils whose center axis is approximately aligned to the direction of the discharge current.

25. A method of manufacturing a carbon nanotube according to claim 17, wherein, of the two electrodes, the magnetic flux density at an edge of the tip of the electrode which generates the discharge plasma is equal to or more than 10^{-5} T and equal to or less than 1 T.

26. A method of manufacturing a carbon nanotube according to claim 17, wherein a density of the discharge current when the discharge plasma is generated is 0.05 A/mm^2 or more and 15 A/mm^2 or less with respect to an area of the tip of the electrode which generates the discharge plasma.

27. A method of manufacturing a carbon nanotube according to claim 17, wherein the voltage applied to the electrodes is equal to or more than 1 V and equal to or less than 30 V.

28. A method of manufacturing a carbon nanotube according to claim 17, wherein the voltage applied to the electrodes by the power supply is a DC voltage.

29. A method of manufacturing a carbon nanotube according to claim 17, wherein:

the voltage applied to the electrodes by the power supply is

a DC voltage; and

the area of the tip of a cathode of the two opposing electrodes is equal to or less than the area of the tip of an anode thereof.

30. A method of manufacturing a carbon nanotube according to claim 17, wherein the material of the electrodes is one of carbon and a substance which contains carbon and has an electric resistivity equal to or more than 0.01 Ω·cm and equal to or less than 10 Ω·cm.

31. A method of manufacturing a carbon nanotube according to claim 17, wherein a pressure of an atmosphere of the discharge area is equal to or more than 0.01 Pa and equal to or less than 510 kPa.

32. A method of manufacturing a carbon nanotube according to claim 17, wherein an atmosphere of the discharge area is a gas atmosphere which contains at least one of gases selected from the group consisting of air, helium, argon, xenon, neon, nitrogen, and hydrogen.

33. A method of manufacturing a carbon nanotube according to claim 17, wherein an atmosphere of the discharge area further includes a gas which includes a substance containing carbon.